AGRICULTURAL NEWS LETTER

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THIS PUBLICATION GIVES INFORMATION on new developments of interest to agriculture based on the work done by scientists and agricultural field men of the du Pont Company and its subsidiary companies.

It also gives reports of results obtained with products developed by these companies in the field whether the tests are made by field men of the companies, by agricultural experiment stations or other bodies. Also data on certain work done by agricultural stations on their own account and other matters of interest in the agricultural field.

This issue contains:

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"LORO"* FOR THE CONTROL OF THE EUROPEAN ELM SCALE SHOWS EXCELLENT RESULTS IN CALIFORNIA EXPERIMENTS

EDITOR'S NOTE:- This report on results obtained with a new insecticide in California is just another indication of the progress science is making along the line of development of radically different and more effective means to combat insect pests.

By: A. F. Swain, Entomologist
E. I. du Pont de Nemours & Co., Inc.
The R. & H. Chemicals Department
Pacific Division
El Monte, California

The beauty of the residential streets of many of the cities of the interior valleys of California is due, to a very great extent, to the enormous old elm trees, planted a generation ago, which completely shade the streets during the entire Summer. In fact, their value cannot be estimated in dollars and cents, as was learned several years ago when the elm leaf beetle first found its way into California and killed thousands of the trees before the people realized their destructiveness, and what the loss of the trees meant to their comfort. Fortunately practically all the cities have kept the beetles under control successfully for the past several years.

More recently, the European Elm Scale (Gossyparia spuria (Modeer)) has become extremely abundant in some districts. For example, in the city of Sacramento during portions of the summer people dare not park their automobiles under the elm trees because of the great quantity of honey dew that drips onto them. In some cases this honey dew becomes so heavy on the pavements that the hazards of automobiles skidding are increased to such a degree that it is extremely dangerous to drive on those streets.

It has been the practice for the past few years for the City Park Department to spray the elms each Spring for the control of this pest. A combination insecticide consisting of 5% commercial lime sulfur solution and 5% dormant oil emulsion has proven to be the most satisfactory lethal agent. However, this cannot be used in close proximity to houses or automobiles because of the disastrous effects of lime sulfur on paint and of oil on stucco.

In cooperation with Messrs. D. B. Mackie and W. B. Carter of the Entomological Division of the California State Department of Agriculture, some experimental spraying with Loro was carried on last spring in Sacramento. On February 27 Loro at 1-400 and at 1-800 with a dormant emulsible oil at 1-200 was applied to heavily infested trees. Preliminary examinations ten days later indicated

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excellent control with Loro at 1-400, but only fair at 1-800 dilution. Consequently on March 11, another test was made using Loro at 1-600 together with a dormant emulsible oil at 1-200.

Mortality counts from these tests, two weeks after application, as determined by Mr. Carter are as follows:

Concentration of Loro	% Dead	
	Males	Females
1-800	89	84
1-600	98	97
1-400	99	97

It will be seen from this that Loro at 1-600 with a small amount of dormant emulsible oil (½%) gave a very satisfactory control. With such a small amount of oil present there should be no fear of injury to paint, stucco or automobile finishes. In fact it appears that there has been a very definite place found for Loro in the control of this universally distributed pest of elm trees.

* "Loro", the trade name for a composition of lorol rhodanates developed and manufactured by the Grasselli Chemical Company, Cleveland, Ohio.

THE USE OF ZINC SULPHATE ON CITRUS AND THE RESULTS SECURED IN FLORIDA

EDITOR'S NOTE:- Evidence of the usefulness of zinc sulphate for treating fruit trees is accumulating. An excellent contribution to a better understanding of the value of zinc in this form is a circular which is presented, in part, below. It is suggested that those interested in citrus culture obtain a complete copy from Dr. Camp, the author.

By A. F. Camp, Horticulturist,
Florida Agricultural Experiment Station,
Gainesville, Florida.

The use of zinc sulphate has proven to be a remedy for frenching (mottle-leaf or chlorosis) of citrus. This trouble has been a continual problem in citrus groves in this state for many years, and in its more severe forms has caused growers a great deal of grief. Frenching is distinguished by a yellowing between the veins of the leaves, with the areas along the veins and the edge of the leaf remaining green. If the trouble is at all severe the leaves are very small and the twigs short, giving a bushy appearance to the tree. The twigs die back from the tip and are particularly subject to cold damage in even mild cold spells. In the more severe forms of the trouble large twigs and even limbs die and the trees become progressively smaller and the yield may fall to practically nothing, the fruit usually being small and hard.

Frenching in a mild form in which only a portion of the leaves are affected is very common throughout the citrus growing area. This form is particularly prevalent on oranges and probably most common on Pineapples and Valencias. The very severe cases show up most commonly on Pineapples on sandy soil and the dying back is very severe and the trees stop bearing marketable fruit after a year or two. These severe cases have caused growers endless trouble and in the past treatments usually have brought no response. We have been carrying on experimental work in a number of groves in which the trees have been affected for 5 years or more and are correspondingly reduced in size and vigor and no fruit of value has been produced recently.

Frenching should be distinguished from other common troubles of citrus which have not been responding to zinc treatments. "Bronzing" of citrus trees is one of these troubles. It is characterized by a bronze color of the whole leaf and a tendency to shed the foliage. The leaves are not materially reduced in size. Zinc sulphate apparently does not correct this and should not in any case be used as a cure-all or to take the place of regular fertilizers.

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The value of zinc sulphate was first discovered in this state in connection with the bronzing of tung trees. This trouble has been a very serious factor in the development of the tung-oil industry, and Mr. Harold Mowry, then a member of the Horticultural Department of the Experiment Station, in 1931 and 1932 showed that applications of zinc sulphate to the soil would bring the trees back into healthy growth. This work was rapidly expanded and the treatment proved a corrective of white bud of corn, rosette of pecans and frenching of citrus. It is evident that these troubles are all related, since they respond to the same treatment. Whether the trouble is a zinc deficiency in the strict sense or whether it is the improved utilization of some other element brought on by the use of zinc has not been determined. At present all of the large groves in the older tung-oil district are being treated with zinc sulphate, applied to the soil. This is probably the first widespread commercial use of zinc sulphate for such agricultural purposes.

The work on citrus followed along the same lines as that on tung trees. It was found that badly frenched Satsuma orange trees responded splendidly to soil applications of zinc sulphate. After a series of failures to obtain results on citrus, experiments were started in March of 1933 in a Satsuma grove at Gainesville. This grove was five years old and had never grown satisfactorily, though carefully fertilized and cultivated. The trees were affected with severe frenching and died back severely each winter, even though the winter was very mild. Treatments applied in March and consisting of one-fourth to one-half pound per tree applied on the soil beneath the tree brought a favorable reaction in about six weeks and by the end of summer were in good condition. An additional treatment was given half the trees in June and those receiving two one-half-pound applications were in the best condition and those receiving only a one-fourth pound application had not responded quite so well. All of the treated trees had put on normal growth with large leaves, long twigs and a good green color; every tree had responded. The untreated trees were badly damaged by light frost during the winter and were almost completely defoliated by spring, whereas the treated trees had hardly lost a leaf and were in excellent condition. The treated trees set a splendid crop of fruit this spring while the untreated trees set only an occasional fruit. This is typical of the responses found in this area, but on the light soils in the citrus belt the soil applications failed to give satisfactory results and often no results at all. It was at first believed that we were dealing with another type of frenching in this area. However, it was found that the trees responded to sprays with exceptional rapidity even though trees in the same grove responded little or none at all to the soil treatments.

A number of groves on the ridge in which Pineapple orange trees had been frenching severely for several years were experimented with by ourselves and others. Trees sprayed with zinc sulphate sprays during the spring months came into vigorous growth in six weeks while evidences of recovery could frequently be observed within four weeks after the spray. The recovery in these groves is astounding, there

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is at this time a large amount of normal growth on the trees, the frenched leaves which were on the trees when the treatment was given have greened up though they have not increased in size. Even trees which were in a very bad condition when treated in the spring put on some fruit that is apparently normal. Untreated trees in the same groves were still frenched and dying back throughout the summer. Valencias, Parson Browns, various varieties of grapefruit and tangerines all showed results.

In these tests the most reliable spray was found to be a zinc-lime spray of the following formula:

5 lbs. 89% zinc sulphate (or proportionately more of lower percentage zinc sulphates)
2½ lbs. finely ground hydrated lime
50 gallons water
Calcium caseinate or blood spreader

In making this up the zinc sulphate should be dissolved separately in a small amount of water. If the 89% product is used the water should be put in a pail or other container and the zinc sulphate run in slowly with vigorous stirring, otherwise it will lump and go into solution very slowly. Fill the spray tank with water and start the agitator and add the hydrated lime slowly so as to make a good suspension, and then add the zinc sulphate solution slowly. Add a spreader in accordance with the instructions on the package--calcium caseinate spreaders must be either screened into the tank, or mixed separately with water--and spray out the tank before stopping the agitator, as the spray is a little heavy and tends to settle badly if the agitator is stopped.

A spray of zinc sulphate and water can sometimes be used successfully, but burning frequently results and such a spray is not recommended. The amount of lime specified above has been found to be about the minimum that is thoroughly safe at all times. Zinc sulphate has also been applied with excellent success when mixed with lime-sulphur, mostly using 5 lbs. of 89% zinc sulphate to 100 gallons of 1 to 50 lime-sulphur. Sometimes wettable sulphur is used to reinforce this spray. The question with regard to this spray is the question of the efficiency of such a mixture for insect control. The addition of the zinc sulphate throws down a lot of free sulphur and may injure the killing power of the spray as far as rust mite and scale are concerned. We are not recommending that this spray be used at present if the lime-sulphur is necessary for insect control. Where the insect control is not so definitely important it can be used with good success. The zinc can also be applied with Bordeaux, by adding 5 lbs. zinc sulphate and 2½ lbs. of lime to the usual Bordeaux. If the Bordeaux is as strong as 4-4-50 it is advisable to add an extra pound of lime to the above.

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In spraying, the entire tree should be thoroughly covered, though it is not necessary to drench the tree heavily. Only those portions of the tree respond which receive the spray, thus making coverage absolutely essential. In several instances, half trees were sprayed with startling results and even in a few weeks the trees became very lop-sided.

Soil treatments have been markedly less successful. In some of the very badly affected groves of large Pineapple trees, the use of 10 to 15 lbs. per tree broadcasted on the soil has brought good results, though not equal to the spray in the same groves. The amounts necessary would seem to make it more economical to spray and there is less chance of failure. In some cases soil applications have failed where sprays have succeeded. This is probably tied up in the question of the soil contents and more work will have to be done on this point. Another point in favor of the spray is the fact that as yet we know little concerning the effects of zinc sulphate on the light soils of the citrus district, and until we do know more it is advisable to use as little zinc sulphate on the soil as possible.

It should be remembered in all cases that this work has not gone on long enough to know that the zinc sulphate will be continuously effective or that no harmful results may be developed in the future. In the case of many severely affected groves this is of little moment, since it is apparently this or nothing and the grove as it stands is highly unprofitable. In such groves, we would recommend definitely the use of zinc sulphate on the basis of the present information, but we are not in a position to recommend it for groves in good condition or groves that show only a trace of frenching.

It is quite probable that spraying will be found to be necessary every year. In tung-oil this is definitely true. It may prove to be less important in citrus, since the tree is not deciduous and the effects may carry over more from year to year. At the present time the grower should figure on yearly spraying. It is also to be considered that the effects can only be outstanding when the trees have a chance to come into growth. The best results have been obtained with spring spraying starting as early as the end of January. It is quite probable that the effects will not be outstanding from sprays applied after the last flush in the fall or from sprays applied to underfed groves that have become hardened. In groves which were partially starved and very hard, with relatively little frenching, the frenched growth has greened up but the trees have been slow to give a growth response. Zinc sulphate will not take the place of fertilizer and trees will only respond if food is available.

GRAIN SEED TREATMENT URGED BY COMMITTEE OF NORTHWEST COUNTRY ELEVATOR OPERATORS

EDITOR'S NOTE: - The statements which follow are from a special report to elevator agents sent out by a committee of grain men representing the country elevators of the Northwest. This report was issued from Minneapolis, Minnesota, February 5, 1935. It is signed by members of the Seed Treatment Committee.* Acknowledgement is made to the United States Department of Agriculture for the use of the accompanying plate which gives details of the construction of a seed treater for farm use.

Within the past two years New Improved Ceresan** has come on to the market as a seed disinfectant for wheat, oats and barley. Experiments and tests by state agricultural experiment stations all over the country and by the U.S.D.A., as well as by the Research Department of the Bayer-Semesan Co., the concern that makes Improved Ceresan, have demonstrated the material is very effective and is the best for its purpose devised to date. Not only does it prevent the smuts of these three grains, with the exception of certain of the loose smuts of wheat and barley, but it also controls barley stripe and prevents a lot of seedling blight and seed decay. The reports concerning New Improved Ceresan have been so generally favorable that we have decided this product is the best one to recommend for elevator use.

"New Improved Ceresan" has so many advantages over the old standbys, formaldehyde and copper carbonate, that we think it will replace them eventually.

Advantages of New Improved Ceresan

1. It is a dust and therefore a dry treatment. There is no swelling of the seed as is sometimes the case with formaldehyde. Formaldehyde treated seed is sometimes injured, particularly if it is not sown soon after treatment, or if sown in dry soil.

2. "New Improved Ceresan" is applied at the rate of one-half ounce per bushel. This is about a tablespoonful and since a bushel of grain takes up most of the dust, there is not as much dust in the air as there is in the case of copper carbonate where from two to three ounces are used. It is, therefore, claimed more agreeable to work with and there is probably less danger of injury to health.

3. "New Improved Ceresan" can be used in the same way on all three grains so it is not necessary for the elevator or farmer to have more than one kind of treating material or equipment on hand.

4. "New Improved Ceresan" will not clog or injure drills if applied at the proper rate. Copper carbonate is rather hard on drills and that is one of the reasons why it has not come into more general use.

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5. "New Improved Ceresan" does not reduce the seeding rate and therefore makes it possible to seed the right amount per acre, thus securing more uniform stands than is the case when formaldehyde or even copper carbonate is used.

6. "New Improved Ceresan" is now the lowest cost dust disinfectant for cereals on the market. It costs more than formaldehyde per bushel, but it is a better disinfectant in many ways.

7. "New Improved Ceresan" improves stands and increases yields even in the absence of smuts. It controls stripe of barley, materially controls many seedling blights and improves initial plant growth and stand.

8. When New Improved Ceresan is used the mixing job does not have to be quite as thorough as is the case with copper carbonate where each kernel should be thoroughly coated. The Ceresan dust partially vaporizes and the vapor penetrates the pile of grain and disinfects.

9. "New Improved Ceresan" treated seed can be stored for at least four weeks after treatment without injury to germination and it can probably be stored a much longer time without injury. Therefore, the use of this chemical makes it possible to treat several weeks in advance of sowing and large scale treating by elevators or portable machines becomes practical.

Costs of Ceresan

The retail prices of Ceresan are: 1 pound tin, 75¢ per pound; 5 pound tin, 60¢ per pound.---. The following table indicates how Ceresan compares with other chemicals in cost per bushel.

Comparison of Costs of Treating Materials

Chemical	Possible Retail Price (per lb.)	Rate of Application	Cost of Chemicals (Cents per bushel)
Copper Carbonate (50%)	25	2 oz. per bu. (1 lb. per 8 bu.)	3.1
Copper Carbonate (18% to 20%)	18	3 oz. per bu. (1 lb. per 5.3 bu.)	3.4
Formaldehyde	20	1 lb. per 50 bu.	0.5
New Improved Ceresan	60	1 lb. per 32 bu.	1.9

Rate of Applying New Improved Ceresan

New Improved Ceresan should be applied at the rate of one-half ounce per bushel of wheat, oats or barley. A smaller amount of dust will not be effective and care also should be exercised not to apply too much. Approximately one ounce per bushel is the maximum amount that can be applied with safety. More than one ounce is likely to injure germination and the longer such treated seed is stored, the more injury will result.

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Although the manufacturers of Ceresan state that treated seed can be stored for two to three weeks* after treating, the Department of Agriculture says it can be stored for four weeks and there are further data to show that in many cases it can be kept for much longer periods. (*Now recommend two to three months.)

How to Apply Ceresan

The manufacturers of New Improved Ceresan, state that the sprinkle and shovel method of application can be used if necessary and where no seed treating machine is available. A bushel of grain is placed on a tight floor or wagon box and one-half ounce of Ceresan is sprinkled over it. Other bushels are added and with each bushel, one-half ounce of dust is applied. The seed is then shoveled from pile to pile three or more times. We believe that this method should only be used in emergencies and with small batches of grain because the chances of doing a thorough job of mixing are not the best and the workers are exposed to the dust more than is desirable.

Mechanical mixers are best for applying New Improved Ceresan. Rotary, barrel mixers or any batch mixer into which the grain and dust can be measured proportionately and thoroughly mixed together are very good. They are rather slow, but are probably the most accurate way of doing the job.

Large capacity mechanical mixers, either of the rotary type or of the gravity type are more suitable for elevator use.

Home Made Machines

In plate 5 is illustrated a Ceresan treater devised by the Bayer-Semesan Company. It is made of twenty-four gauge galvanized sheet metal, or heavier. Grain is run into the top funnel, which is kept full and the Ceresan is added by hand at the rate of one-half ounce per bushel. Before using the treater a few bushels should be run through to determine the number of seconds required for one bushel to pass. The working plans shown in plate 5 will enable any sheet metal worker to construct this machine. The cost should not be over $15. The mixer is particularly adaptable to farm use and can be substituted for the rotary barrel machine. Several farmers could cooperate in the purchase and use of such a machine. (This machine can be made by taking a 55-gallon oil drum and following the diagram given in plate 5, increasing the diameter of the funnels and cone to coincide with that of the drum. If larger capacity for the receiving chamber is desired, a collar may be added to the top of the drum - Editor.)

Precautions in Using Ceresan

Since Ceresan is a poisonous dust, it should not be taken internally. Surplus treated seed should not be fed to farm animals until it has been thoroughly washed. If an animal should accidentally eat some grain treated with New Improved Ceresan, it would require at least two bushels to administer a lethal dose.

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A dust mask should be used by operators engaged in the treatment of large quantities of seed grain. Care should be taken to avoid inhaling any more of it than possible. No reports of injury have come to our attention with the exception of a skin rash caused by leaving the chemical on the skin too long. Farmers using Ceresan treated seed should be cautioned to hold the seed in a pile for at least ten hours before seeding. This time is needed for the Ceresan to disinfect. Farmers should not take the seed home and plant it the same day.

Ceresan Treatment Pays

Quoting from reports of field experiments of the research departments of the Bayer-Semesan Company, some of which were conducted in Minnesota and North Dakota, they state:

"In 65 tests over a three year period (1932-34) New Improved Ceresan treated seed oats have outyielded untreated seed by 3.2 bushels an acre or over 18 per cent.

"Thirty tests on barley during 1932, 1933 and 1934 .... showed that New Improved Ceresan increased the yield over untreated seed by nearly 6 per cent.

"Tests on winter wheat in Georgia and Kansas, as well as spring wheat in Minnesota, North Dakota and South Dakota -- 38 tests in all -- prove that New Improved Ceresan increased the yield even from apparently smut-free or clean seed. The average increase in yield was more than a bushel per acre or nearly 6 per cent."

In the latest publication on seed treatment by the U. S. Dept. of Agriculture (Misc. Pub. 219), New Improved Ceresan is recommended as the only treatment generally applicable to all three grains, wheat, oats and barley.

Several state experiment stations recommend New Improved Ceresan and many extension specialists and county agents are advocating it.

As a committee we recommend the use of New Improved Ceresan for seed treatment. We endorse several of the machines discussed in this report and we most earnestly urge elevators and farmers generally to treat all seed grain this spring.

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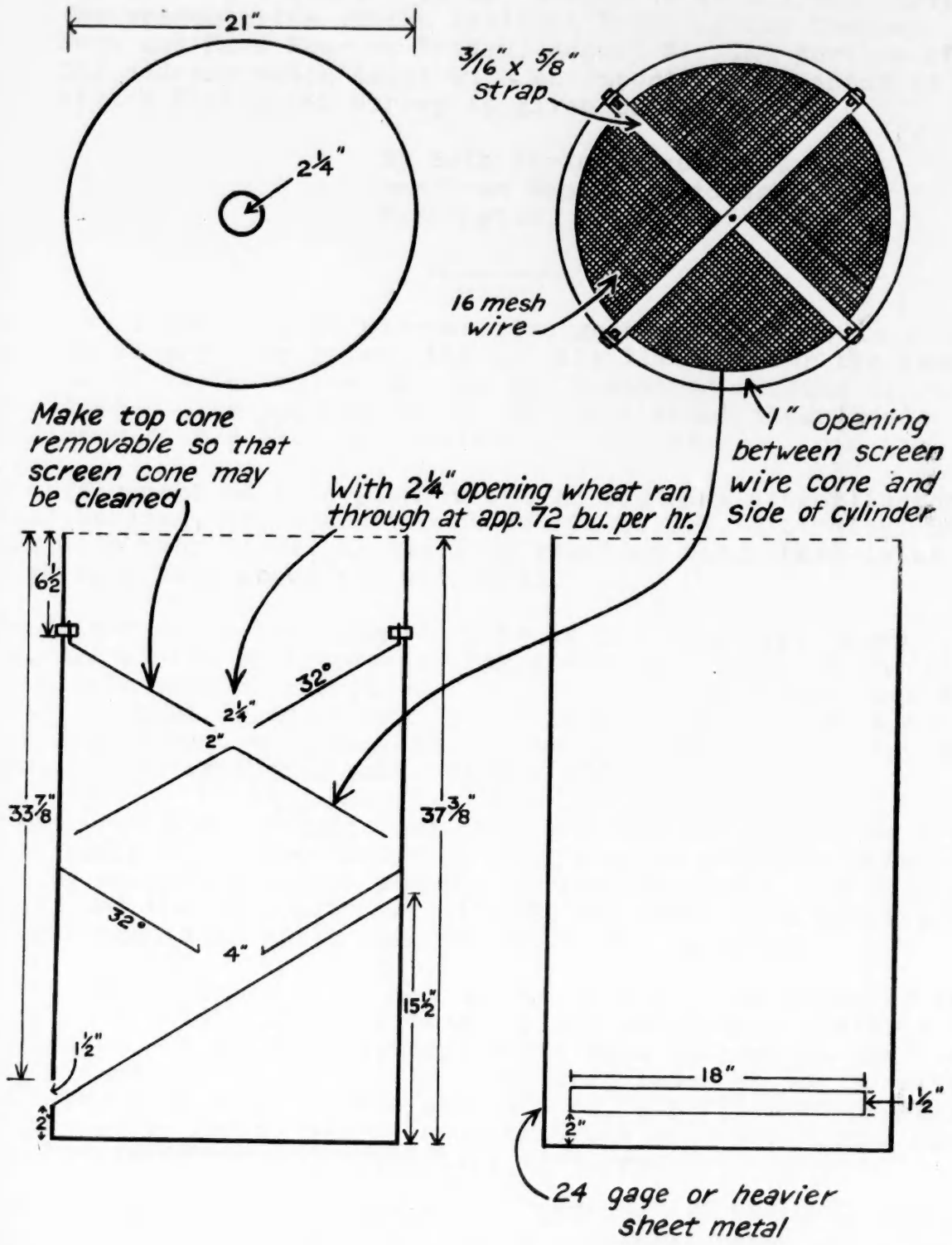
* J. H. Ehrle, Osborne-McMillan Elevator Co., Chairman; F. C. Riebe, Kellogg Commission Co.; O. M. Smith, Farmers National Grain Corp.; J. V. McCarthy, McCarthy Bros. Co.; Jas. D. Collinson, Brown Grain Co.

** "New Improved Ceresan" is the trade name for the ethyl mercury phosphate dust developed and manufactured by the Bayer-Semesan Company, Wilmington, Delaware.

Plate 5



Courtesy of
U. S. Dept. of Agriculture

UNITED STATES BIOLOGICAL SURVEY TO DIRECT WILDLIFE RESEARCH AND MANAGEMENT TRAINING

EDITOR'S NOTE:- Recent developments in wildlife conservation were discussed by Mr. Gordon in an address during the presentation of the National Broadcasting Company Farm and Home Hour on Friday, August 2. The portion of the address which dealt with an important new activity of the Biological Survey is given below.

By Seth Gordon, President,
American Game Association,
Washington, D. C.

And, now, I am going to discuss some good news. This is about a new plan to pry deeply into the private lives of our big game animals and of their smaller furred and feathered cousins of our farms and ranches. The purpose is to learn all about their needs and requirements in a thorough, scientific manner.

The development of this plan is one of the many accomplishments of "Ding" Darling, the energetic chief of the U.S. Biological Survey. Along with many of us, he has long realized that there is still a lot we must know about our wildlife.

Information of an ecological nature is yet relatively meager. Our knowledge of the environmental requirements of most of our birds and animals must be increased. While a great deal has been done during the past decade along these lines, especially with the bobwhite quail, much more must be learned concerning the vital factors governing the existence and increase of our wildlife.

The proposed plan seeks to get this information and to train workers to apply it to the land. It is a program jointly financed by a group of eastern arms and ammunition manufacturers, the Biological Survey, and the agricultural colleges and state game commissions in those states in which the work is to be conducted.

The Biological Survey will act as the central, coordinating agency through which this wildlife research and management training will be directed. Present funds enable the work to proceed immediately in only nine states, but it is hoped that later it may be extended to all the states. In these nine states, experimental projects will be set up for wildlife demonstrations and educational purposes on public lands and on cooperative farm areas.

Courses of study in game management will be developed by the agricultural colleges where this work is undertaken, and the research program will develop sound management practices which may be applied to all our lands, public and private. Advanced biological students

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will get first hand experience in research methods and game management practices.

Wildlife, after all, is simply a land drop which can be made to pay adequate annual dividends by intelligent management and use. When we have the needed knowledge and the trained men to apply such practices on our 6,000,000 farms and ranches, we will make conservation progress. The American Game Association views this undertaking with the greatest of enthusiasm. It will produce a corps of trained wildlife technicians, and demonstration projects will do for wildlife what experiment stations have done so successfully for agriculture and animal husbandry.

TRENCH SILOS BLASTED WITH DYNAMITE CAN HELP SOLVE CATTLE FEED PROBLEM

EDITOR'S NOTE:- Expected shortages of grain crops, reported from sections of the country, are causing concern among farmers who foresee difficulty in providing feed for farm animals during the Winter months. Lack of silos or the inadequate capacity of existing ones further complicates the situation, it is held. This article will, it is hoped, be helpful in solving the problem.

By L. F. Livingston, Manager,
Agricultural Extension Section,
E. I. du Pont de Nemours & Co.

The practice of storing feeding stuffs for animals in pits in the earth is centuries old. It was resorted to by ancient peoples abroad and by certain Indian tribes in America. Trench silos are now coming into greater use by farmers in various parts of the country. This type of silo can be constructed at relatively low cost. When properly designed and located in suitable soil, it is quite satisfactory, if kept in condition.

Even on farms where there are silos constructed of wood or concrete there is need for storage capacity for silage in years when there is a shortage of grains, as is reported from some sections at present.

The Use of Explosives

Usually, soil can be loosened with a plow and removed with a horse-drawn scraper. It is not customary to blast the lighter soils. Soil which is not too heavy to handle with a scraper, but which is difficult to plow, can be broken up with dynamite. The use of explosives has advantages for breaking hard clay soil or removing most of it. Soil which is heavy and moist will probably require blasting. However, a moist spot is not a good location for a trench silo.

With this kind of blasting, as with any other, it is not possible to lay down hard and fast rules for doing the work. The type of soil, whether dry or moist, the dimensions of the projected trench, the purpose of the blasting -- whether to merely break up the soil or blast out most of it, the proximity of buildings, and other factors must be taken into consideration.

Care should be exercised not to disturb the earth near the side-walls. That, however, can be prevented by not loading too heavily, but blowing the soil out of the center to form a sloping excavation. Soil not removed by the blasting can be taken out with a

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scraper. A spade or pick and shovel can be used to dress the side-walls. The blast will partially loosen the material at the sides, making it easy to handle.

It is seldom advisable to attempt to do all the excavating with explosives, although under the most favorable conditions and with an expert blaster doing the work, it has been done. Of course, even then some of the earth had to be removed by scraping or otherwise and dressing done.

Mostly, dynamite is used either (1) to break hard baked topsoil to make plowing easier or (2) loosen up the earth for practically the entire depth of the trench.

One or more test shots -- the shooting of single holes -- will enable the blaster to fairly well determine by careful examination the extent of the area in which the earth has been shattered by the blasting.

An Approved Blasting Method

Some agricultural engineers have found that the most satisfactory results from blasting, especially of heavy clay soil, are obtained by doing the shooting in two stages. Representative of this method is the procedure for excavating a trench which when completed -- including scraping and dressing the side-walls -- would be approximately 12 feet wide at the top with the sides sloping to a bottom width of 8 feet, and with a depth of 8 feet.

Two rows of holes, 3½ feet deep, with each row two feet from the center-line and paralleling it, are put down on four-foot spacing. Each hole is loaded with two to three sticks of dynamite. The top cartridge in each hole is primed with an electric blasting cap. The caps are wired in series and fired with an electric blasting machine. It is usual to blast the entire length of the trench at one time. The blast will throw out considerable material and thoroughly break up the rest of it to a depth of about four feet. All the loosened earth should be scraped out.

After this first blast has been fired, the side-walls should be examined carefully in order to determine the amount of dynamite to use for the second stage of the shooting. Also, the depth obtained by the blast and subsequent scraping should be noted.

If an approximate depth of four feet has been obtained, the first operation is repeated, but the charges of dynamite are reduced to 1½ to two sticks per hole. Should the depth obtained by the first-stage blasting be less than four feet, and the sides are not disturbed too much, two sticks of dynamite would be the minimum to use. While not as much earth will be thrown out by the second blast, some will be removed.

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Hand dressing of the walls should be done after the second blast. It is sometimes well to delay the scraping of the bottom of the trench until after the work of dressing has been completed, so that the material which has fallen into the trench may be removed along with that loosened by the blast.

Observing Safety Rules

Blasting of any sort should be done only by an experienced blaster. The user of explosives should be familiar with safety rules and observe them strictly. One of the things that must be considered in blasting a trench is that small rocks may be blown out as well as earth. The blaster and all others present should take a safe distance.

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